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Original Research

Comparative analysis of short-term therapeutic efficacy: Radiofrequency microtenotomy vs. Steroid injection in lateral epicondylitis

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Abstract

Aim: The aim of this study was to compare the retrospective short-term therapeutic efficacy of radiofrequency microtenotomy (RFMT) and steroid injection in lateral epicondylitis.

Material and Methods: Data from lateral patients with epicondylitis who had undergone conservative treatment for at least six months but experienced no improvement in pain were retrospectively reviewed. Patients meeting the inclusion criteria were divided into two groups: those who underwent radiofrequency microtenotomy and those who received steroid injections. Grip strength, pincer strength, Visual Analog Scale (VAS), Disabilities of the Arm, Shoulder and Hand (DASH), and Mayo Elbow Performance Score (MEPS) were compared for both groups at preoperative and postoperative 1st, 3rd, and 6th months.

Results: When comparing postoperative 1st-month VAS, DASH scores, and grip strength measurements of both groups, significant differences were observed, while there were no significant differences in MEPS and pincer strength measurements (p=0.028, p=0.018, p=0.001, p=0.082, p=0.169, respectively). Although there were no significant differences in the postoperative 3rd-month VAS, MEPS, grip strength, and pincer strength measurements between the two groups, a significant difference was found in DASH scores (p=0.237, p=0.185, p=0.382, p=0.979, p=0.030, respectively). Significant differences were observed in the postoperative VAS, DASH, MEPS, grip strength, and pincer strength measurements between both groups (p=0.001 for all tests).

Discussion: RFMT method provided more favorable clinical and functional outcomes compared to steroid injection at the end of the sixth month. These results suggest a strong potential for RFMT in the treatment strategy for lateral epicondylitis. However, comprehensive studies involving larger patient groups and longer follow-up periods are required to determine the exact role of RFMT

Keywords

Lateral Epicondylitis, Radiofrequency Microtenotomy, RFMT, Steroid Injection, Treatment Efficacy, Clinical Outcomes

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Introduction

Lateral epicondylitis, also known as tennis elbow, is a condition seen in adults and is present in about 1-3% of cases. It involves lesions around and at the origin of the common extensor tendon [1, 2]. Particularly in histological sections at the origin of the extensor carpi radialis brevis tendon, non-inflammatory angiofibroblastic tendinosis and myxoid degeneration have been identified [3]. Treatment ranges from activity limitation to surgical intervention, encompassing a wide spectrum. However, there has been no consensus that any one treatment is superior to others as the gold standard therapy [4, 5]. Steroid injections have been used since the 1950s, however, it is known that although they reduce symptoms in the first 6 weeks, their effectiveness becomes limited after the 3rd month [6].

In recent years, RFMT has been introduced as an alternative treatment for lateral epicondylitis (LE). Despite debates about its effectiveness, it has been reported to be a safe method in human trials. The aim of this study is to compare the clinical outcomes of steroid injection and RFMT in the treatment of LE.

Material and Methods

Ethical Approval and Study Protocol

Our study was reviewed and approved by Selcuk University Ethics Committee on September 1, 2023 (Decision No: 2023/4482). Between August 1, 2021, and February 1, 2023, patients diagnosed with lateral epicondylitis were examined at the Orthopedics and Traumatology Clinic of Hakkari State Hospital by a single orthopedic surgeon who had received at least five years of orthopedic training. Among these patients, those who underwent RFMT and steroid injection by the same orthopedic surgeon were included and divided into two groups. Age, side, gender, grip and pincer strength measurements at preoperative, postoperative 1st month, postoperative 3rd month, and postoperative 6th month, as well as VAS, DASH, and MEPS scores of both groups were evaluated and compared with each other. The measurements of grip strength and pincer strength are shown in Figure 1.

Patients and Inclusion/exclusion criteria

Inclusion criteria comprised patients diagnosed with lateral epicondylitis who had been experiencing pain aggravated by wrist dorsiflexion with tenderness over the common extensor origin for at least six months. These patients had initially received NSAID treatment and had undergone epicondyle straps application; however, they exhibited no improvement in their symptoms. Among these cases, those who underwent RFMT or steroid injection were included in the study.

Exclusion criteria involved patients with a history of ipsilateral upper extremity or cervical surgery that could affect the study results. Patients who did not adhere to the specified clinic follow-up dates and those diagnosed with seronegative/seropositive/crystal-induced inflammatory arthropathies were also excluded.

RFMT and Steroid Injection Procedure

Both procedures were performed under local anesthesia, and a 2 mg/kg PRILOC %2 (VEM Pharmaceuticals, Çankaya/ANKARA) was administered to the procedure area. For RFMT, a 2 square centimeter area was identified over the tender lateral epicondyle. The probe tip was inserted perpendicular to the skin at 2-millimeter intervals, and the duration of the procedure was 0.5 seconds. As for the steroid injection, following the administration of local anesthesia to the affected area, a 20 mg DEPO-MEDROL (PFIZER PFE Pharmaceuticals, Ortaköy/Istanbul) injection was administered. After the procedures, patients were monitored for a minimum of 30 minutes for the possibility of acute complications. Figure 2 demonstrates the RFMT process.

Postop Rehabilitation

Patients were advised to avoid active movement of the affected upper extremities and to use splints for up to 48 hours post-procedure. After 48 hours, they were permitted to engage in active movement and apply loads. All patients who underwent the procedure were recommended to abstain from using NSAIDs and smoking for at least 6 months after the procedure.

Statistical Analysis

SPSS 26.0 (Statistical Package for the Social Sciences) program was used for data analysis (Graph Pad Software, Inc., La Jolla, CA). Fisher's exact test and the chi-square test were used to evaluate categorical variables (gender, affected

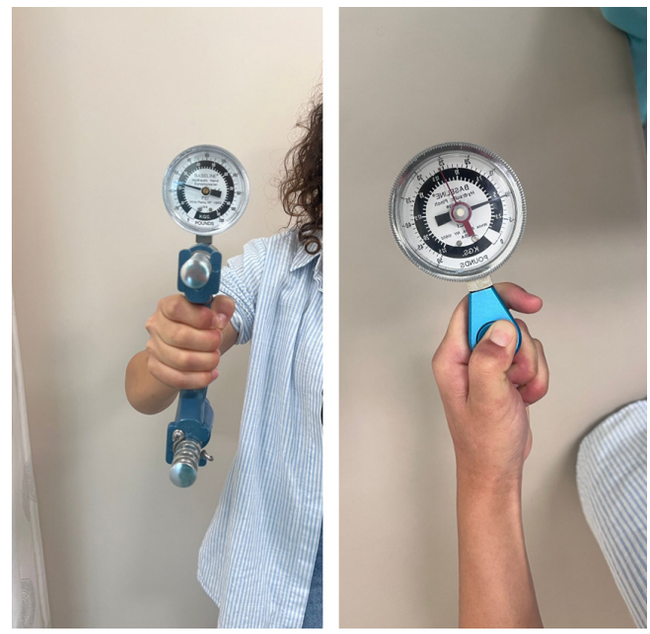

Figure 1. Measurements of grip strength and pincer strength

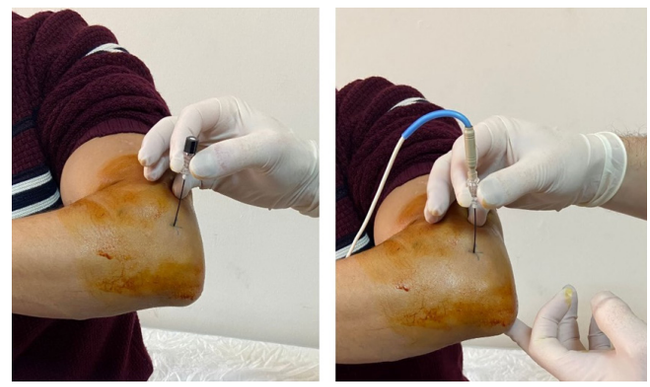

Figure 2. RFMT Procedure: Initially, the area of sensitivity over the lateral epicondyle where the extensor tendons attach is identified. Subsequently, radiofrequency microtenotomy is performed on a two-square-centimeter area at two-millimeter intervals.

side). Skewness and kurtosis values were examined to determine whether continuous variables (age, grip strength, pincer strength, VAS, DASH and Meps scores at postoperative 1st, 3rd and 6th months) fit a normal distribution. Statistical analysis of "One-Way Analysis of Variance" was used when comparing the parameters of both groups with each other. "Repeated Measures ANOVA" statistical analysis was used when comparing the postoperative values of the groups with the preoperative values. The minimum (min), maximum (max), median, mean and standard deviation (SD) values of these parameters were recorded and the level of significance was determined as p-value < 0.05 in all tests.

Results

The clinical and functional scores of 80 patients who met the inclusion criteria were analyzed. Clinical follow-up of the enrolled patients was conducted at postoperative 1st, 3rd, and 6th months. Of the 80 patients, 40 underwent RFMT while the remaining 40 received steroid injections. The mean age of the RFMT group was 44.05 ± 10.71, and for the steroid injection group, it was 42.45 ± 9.51. There were no significant differences between the two groups in terms of age, gender, and affected side (p=0.482, p=0.823, p=0.412).

No significant differences were observed in preoperative VAS, DASH, MEPS, grip strength, and pincer strength measurements for both groups (p=0.537, p=0.728, p=0.904, p=0.447, p=0.986). Significant differences were observed in postoperative 1st-month VAS, DASH, and grip strength measurements for both groups, while no significant differences were found in MEPS and pincer strength measurements (p=0.028, p=0.018, p=0.001, p=0.082, p=0.169). There were no significant differences in postoperative 3rd-month VAS, MEPS, grip strength, and pincer strength measurements between the two groups, but a significant difference was observed in DASH scores (p=0.237, p=0.185, p=0.382, p=0.979, p=0.030). When comparing postoperative VAS, DASH, MEPS, grip strength, and pincer strength measurements between the two groups, significant differences were found (p=0.001, p=0.001, p=0.001, p=0.001, p=0.001). Data including measurements and comparisons for both groups are provided in Table 1.

Comparing the preoperative and postoperative 1st-month measurements of the RFMT group, no significant differences were observed in terms of VAS, DASH, MEPS, grip strength, and pincer strength (p=0.420, p=0.202, p=0.949, p=0.249, p=0.949). Similarly, comparing the preoperative and postoperative 3rd-month measurements of the RFMT group, no significant differences were observed in terms of VAS, DASH, MEPS, grip strength, and pincer strength (p=0.127, p=0.270, p=0.774, p=0.152, p=0.774). However, comparing the preoperative and postoperative 6th-month measurements of the RFMT group, significant differences were observed in terms of VAS, DASH, MEPS, grip strength, and pincer strength (p=0.001, p=0.002, p=0.009, p=0.009, p=0.001). Data illustrating the RFMT group's preoperative measurements compared to measurements at

Table 1. Scoring of Patients Undergoing RMFT and Steroid Injection

	RMFT group (n=40)		Steroid group (n=40)		p
	Mean ± SD	Min-Max-Median	Mean ± SD	Min-Max-Median	
Age	44,05 ± 10,71	27-62-35,00	42,45 ± 9,51	25-62-37	0,482
VAS score					
Preoperative	8,75 ±,84	7,00-10,00-9,00	8,65 ±,58	8,00-10,00-9,00	0,537
1st month	8,48 ±,75	7,00-10,00-8,00	8,05 ±,93	6,00-9,00-9,00	0,028
3rd month	8,40 ±,71	7,00-9,00-9,00	8,20 ±,79	7,00-10,00-9,00	0,237
6th month	7,65 ±1,23	5,00-9,00-7,50	8,90 ±,74	8,00-10,00-9,00	0,001
DASH score					
Preoperative	47,38 ±7,75	37,50-67,50-45,00	47,89 ± 5,20	38,30-57,50-47,50	0,728
1st month	50,23 ± 7,22	38,30-68,30-51,70	55,85 ± 12,78	31,70-85,80-55,00	0,018
3rd month	50,21 ± 7,19	42,50-66,70-49,20	55,27 ± 12,50	30,00-85,00-55,85	0,03
6th month	56,47 ± 11,74	41,70-82,50-58,35	48,79 ± 4,51	42,50-58,30-48,30	0,001
MEPS					
Preoperative	74,88 ± 10,59	50,00-90,00-75,00	75,13 ± 7,64	65,00-90,00-75,00	0,904
1st month	77,63 ± 6,20	65,00-85,00-80,00	80,63 ± 8,78	60,00-90,00-82,50	0,082
3rd month	78,00 ± 7,05	65,00-95,00-80,00	79,88 ± 5,37	65,00-90,00-80,00	0,185
6th month	81,63 ± 5,11	70,00-95,00-80,00	76,13 ± 5,60	65,00-90,00-75,00	0,001
Grip Strength					
Preoperative	45,20 ± 7,18	28,00-55,00-45,50	46,23 ± 4,50	39,00-56,00-46,00	0,447
1st month	47,98 ± 4,40	39,00-53,00-50,00	50,90 ± 3,35	43,00-60,00-50,00	0,001
3rd month	48,40 ± 4,87	39,00-60,00-50,00	49,45 ± 5,78	39,00-60,00-50,00	0,382
6th month	50,90 ± 3,35	43,00-60,00-50,00	45,08 ± 7,11	28,00-55,00-44,50	0,001
Pincer Strength					
Preoperative	10,23 ± 1,59	6,50-12,50-10,25	10,23 ± 1,52	6,50-12,50-10,25	0,986
1st month	10,64 ± ,93	8,75-11,75-11,00	10,94 ± ,96	8,00-11,50-10,50	0,169
3rd month	10,70 ± 1,06	8,75-13,25-11,00	10,71 ± 1,06	9,00-13,50-11,00	0,979
6th month	11,24 ± ,77	9,50-13,25-11,00	10,27 ± ,77	9,50-13,00-11,00	0,001

Table 2. Comparison of Preoperative and Postoperative Measurements by Months for the RFMT and Steroid Injection Groups

	VAS			DASH			MEPS		
	Preop 1st month	Preop 3rd month	Preop 6th month	Preop 1st month	Preop 3rd month	Preop 6th month	Preop 1st month	Preop 3rd month	Preop 6th month
RFMT	0,42	0,127	0,001	0,202	0,27	0,002	0,949	0,774	0,009
Steroid	0,012	0,007	0,518	0,03	0,05	0,393	0,03	0,018	1

	Pincer Strength			Grip Strength		
	Preop 1st month	Preop 3rd month	Preop 6th month	Preop 1st month	Preop 3rd month	Preop 6th month
RFMT	0,949	0,774	0,009	0,249	0,152	0,001
Steroid	0,047	0,703	1	0,001	0,027	1

different postoperative months are provided in Table 2.

Comparing the preoperative and postoperative 1st-month measurements of the steroid injection group, significant differences were observed in terms of VAS, DASH, MEPS, grip strength, and pincer strength (p=0.012, p=0.012, p=0.03, p=0.001, p=0.047). When comparing the preoperative and postoperative 3rd-month measurements of the steroid injection group, significant differences were observed in terms of VAS, DASH, MEPS, and grip strength, while no significant difference was seen in pincer strength measurements (p=0.007, p=0.050, p=0.018, p=0.027, p=0.703). Comparing the preoperative and postoperative 6th-month measurements of the steroid injection group, no significant differences were observed in terms of VAS, DASH, MEPS, grip strength, and pincer strength (p=0.518, p=0.393, p=1.000, p=1.000, p=1.000). Data illustrating the steroid injection group's preoperative measurements compared to measurements at different postoperative months are provided in Table 2.

Discussion

In this study, the effectiveness of RMFT and steroid injection was evaluated in patients who had previously undergone non-invasive conservative treatments but did not achieve success. The clinical and functional evaluations of patients who underwent two different treatment methods (RMFT and steroid injection) were presented during the preoperative and postoperative periods. Initially, it was noted that there were no significant differences between the preoperative measurements of both groups. This indicates that patients in both groups were evenly distributed. In this study with a substantial amount of data, two key findings particularly stand out. The first observation is that in the 1st month after steroid injection, there was a significant improvement in VAS, DASH, and grip strength measurements compared to the RMFT group, reflecting positive clinical and functional scores. We believe this could be attributed to the rapid regression of symptoms due to the anti-inflammatory effects following steroid injection.The second significant finding is that in the 6-month mark, RMFT appears to be superior to steroid injection across all parameters. We attribute this result to the effective triggering of angiogenic and regenerative healing processes by the RMFT method, and we speculate that the limited effectiveness of steroid injection treatment in the long term plays a role in this outcome.

There are publications reporting that RF-based microtenotomy is a treatment method that achieves healing through tissue fragmentation and angiogenic effects [7, 8]. It has been suggested that in tissues treated with this method, the presence of angiogenic stimulants such as fibroblast growth factor and vascular endothelial growth factor can lead to regeneration and healing [9]. Harwood and colleagues showed an increase in vascular endothelial growth factor (VEGF) levels after radiofrequency application in rabbits with an Achilles tendinosis model [10]. In the same study, they also reported that the increase in basic fibroblast growth factor or VEGF led to an increase in type 1 collagen and extracellular matrix molecules, resulting in increased tendon strength. Takahashi et al., in a study evaluating radiofrequency effectiveness in rats, demonstrated rapid degeneration and ablation of nerve fibers, resulting in decreased early postoperative pain in tendinosis treatment [11]. RMFT may contribute to the reduction of pain in the early stages by promoting the degeneration of pain-causing nerve fibers. In fact, Waseem and colleagues have pointed out that neurogenic inflammation exists in the pathogenesis of lateral epicondylitis due to the presence of substance P and calcitonin gene-related peptide (CGRP) in the tendon. In our study, we believe that the success of RFMT treatment at the sixth month supports this theory, as it may be due to the degeneration of nerve fibers and suppression of neurogenic inflammation. Moreover, we have confidence that the long-term effectiveness of angiogenesis induced by RFMT will undoubtedly surpass that of steroid injection treatment. Additionally, harnessing the angiogenesis in the tendon could lead to complete healing in the patient over the long term through regenerative processes.

The results of the first patient group treated with radiofrequency in lateral epicondylitis were reported by Tasto and colleagues [9]. They reported positive improvements in patients' functional and clinical scores. Similarly, in our study, we observed improvements in clinical scores among lateral epicondylitis patients. Meknas and colleagues, in a study published in 2008 comparing RFMT to open surgery, reported that RFMT was more effective in the short term compared to open surgery and yielded similar results in the long term [12]. Furthermore, in a study by Meknas and colleagues in 2013, where they reported at least 5 years of follow-up on the same patient group, they stated that patients benefited from RFMT in the long term [13]. One of the drawbacks of RFMT application is that it may incur higher costs compared to other conservative methods (such as

steroid injections, epicondylitis bands, NSAIDs, etc.) due to the additional cost of probes. Additionally, skin depigmentation, adipose tissue atrophy, and tendon weakening, which are known side effects of steroids mentioned in the literature, have not been reported in our literature searches for RFMT treatment [14]. While this study did not include a patient group undergoing arthroscopic or open extensor tendon release, it is noteworthy that RFMT treatment offers the advantage of not requiring regional or general anesthesia, unlike the other two treatments. Despite the study's limitations, which include its retrospective nature and a relatively small patient group, we believe that considering its role as an alternative treatment for LE, a common condition causing workforce loss, is essential before opting for surgical intervention.

Conclusion

Our findings demonstrate that the RFMT method yields more favorable clinical and functional results compared to steroid injection at the six-month mark. These results indicate that RFMT holds promise as a safe and significant component of lateral epicondylitis treatment strategies. We recommend its implementation before considering surgical interventions in cases where other conservative treatments have been applied but failed. However, to determine the precise position of RFMT in the lateral epicondylitis treatment algorithm, more comprehensive studies encompassing larger patient groups and longer follow-up periods are required. Such studies will shed light on the long-term effectiveness of RFMT, its impact on different patient profiles, and its comparative efficacy against other treatment methods. These comprehensive data will allow for a more detailed and reliable assessment of RFMT's role in lateral epicondylitis treatment protocols.

Limitation

There are a few limitations to our study. Firstly, its retrospective and small-scale nature. A prospective study with a larger patient group would undoubtedly yield more data and provide stronger results. Secondly, the inclusion of pre- and post-operative radiological imaging (such as MRI or ultrasound) for patients could contribute significantly to the study.

Scientific Responsibility Statement

The authors declare that they are responsible for the article's scientific content including study design, data collection, analysis and interpretation, writing, some of the main line, or all of the preparation and scientific review of the contents and approval of the final version of the article.

Animal and Human Rights Statement

All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or compareable ethical standards.

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Conflict of Interest

The authors declare that there is no conflict of interest.

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